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U.S. Hydropower Resource Assessment for New Jersey

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ABSTRACT

The U.S. Department of Energy is developing an estimate of the undeveloped hydropower potential in the United States. The Hydropower Evaluation Software (HES) is a computer model that was developed by the Idaho National Engineering Laboratory for this purpose. HES measures the undeveloped hydropower resources available in the United States, using uniform criteria for measurement. The software was developed and tested using hydropower information and data provided by the Southwestern Power Administration. It is a menu–driven program that allows the personal computer user to assign environmental attributes to potential hydropower sites, calculate development suitability factors for each site based on the environmental attributes present, and generate reports based on these suitability factors. This report describes the resource assessment results for the State of New Jersey.

ACKNOWLEDGMENTS

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INTRODUCTION

In June 1989, the U.S. Department of Energy initiated the development of a National Energy Strategy to identify the energy resources available to support the expanding demand for energy in the United States. Public hearings conducted as part of the strategy development process indicated that undeveloped hydropower resources were not well defined. As a result, the Department of Energy established an interagency Hydropower Resource Assessment Team to ascertain the undeveloped hydropower potential. In connection with these efforts by the Department of Energy, the Idaho National Engineering Laboratory designed the Hydropower Evaluation Software (HES), which has been used to perform a resource assessment of the undeveloped conventional hydropower potential in over 30 states. This report presents the results of the hydropower resource assessment for the State of New Jersey. Undeveloped pumped storage hydropower potential is not included.

The HES was developed as a tool to measure undeveloped hydropower potential regionally or by state. The software is not intended to provide precise development factors for individual sites, but to provide regional or state totals. Because the software was developed as a generic measurement tool encompassing national issues, regional and state totals must be considered judiciously; various local issues may skew undeveloped hydropower potential totals. The information for the resource assessment was compiled from the Federal Energy Regulatory Commission's Hydroelectric Power Resources Assessment database and several other sources. Refer to DOE/ID–10338, the *User's Manual* (Francfort, Matthews, Rinehart 1991) for the specifics of the software and to DOE/ID–10430.1, the *Status Report* (Conner, Francfort, Rinehart 1996) for an overview of all resource assessment activities to date.

Model Development

Hydropower Evaluation Software, both a probability–factor computer model and a database, is a menu–driven program that is intended to be user–friendly. Computer screens and report–generation capabilities were developed to meet the needs of users nationwide. The software uses environmental attribute data to generate an overall project environmental suitability factor (PESF) between 0.1 and 0.9, where 0.9 indicates the highest likelihood of development and 0.1 indicates the lowest likelihood of development. The suitability factors are dependant on the unique environmental attributes of each potential site. They reflect the considerations that (a) environmental concerns can make a potential site unacceptable, prohibiting its development (for a suitability factor of 0.1), or (b) if there are no environmental concerns, there is no effect on the likelihood of site development (for a suitability factor of 0.9). A combination of attributes can result in a lower suitability factor because multiple environmental considerations would reduce the likelihood that a site may be developed to its physical potential.

Model Goal

The goal of the HES is to assemble an accurate resource database of all sites with undeveloped hydropower potential in the United States for use as a planning tool to determine the viable national hydropower potential. Undeveloped hydropower potential is not limited to the development of new sites; it also includes the development of additional hydropower–generating capacity at sites that currently have hydropower, but are not developed to their full potential. This undeveloped hydropower potential is a source of nonpolluting, renewable energy available to meet the growing

power needs of the United States. The HES should help make this goal obtainable and ensure a set of uniform criteria for national assessment.

Dam Status

The effects of environmental attributes vary by dam status. The dam status classifications used are as follows

W = Developed hydropower site with current power generation, but the total hydropower potential has not been fully developed. Only the undeveloped hydropower potential is discussed in this report.

W/O = Developed site without current power generation. The site has some type of developed impoundment or diversion structure, but no developed hydropower generating capability.

U = Undeveloped site. The site does not have power generation capability nor a developed impoundment or diversion structure.

ASSESSMENT RESULTS

Summary Results

A total of 12 sites (Table 1) have been identified and assessed for their undeveloped hydropower potential. The HES results for individual site capacities range from 23 kilowatts (kW) to 4 megawatts (MW). Most sites (83%) have potential capacities of under 1 MW (Figure 1).

The nonmodeled undeveloped hydropower potential total for New Jersey was identified as 11 MW. The HES results lowers this estimate about 18% to 9 MW. New Jersey did not report any sites with undeveloped hydropower potential at sites with current generating capabilities. Overall, the HES–modeled results did not significantly change the capacity in undeveloped hydropower potential (Figure 2). The number of sites does not change, only the identified undeveloped hydropower potential is reassessed (Figure 3).

The 12 identified sites are located within 1 major river basin and 9 minor river basins. The major river basin, the Delaware, contains 3 hydropower sites, and the remaining 9 sites are located in minor river basins (Figure 5). The majority of the undeveloped hydropower potential (97%) in New Jersey is located in the minor river basins (Figure 6).

Table 1. Undeveloped hydropower potential summaries for New Jersey. The table contains the nonmodeled undeveloped name plate potential, as well as the HES-modeled undeveloped hydropower potential totals.

	Number of projects	Name plate potential (MW)	HES-modeled potential (MW)
With Power	0	0	0
W/O Power	9	6.1	5.3
Undeveloped	3	4.6	4.1
State Total	12	10.7	9.4

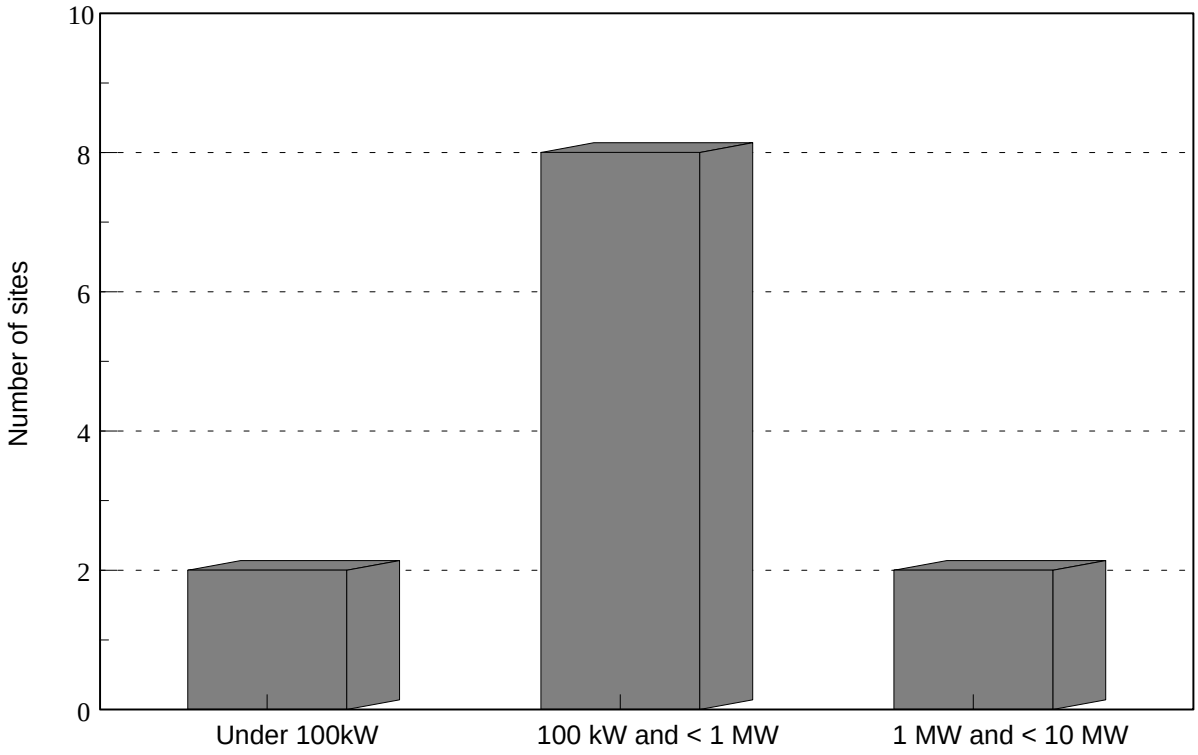

Figure 1. Number of sites, by capacity groups, with HES-modeled undeveloped hydropower potential.

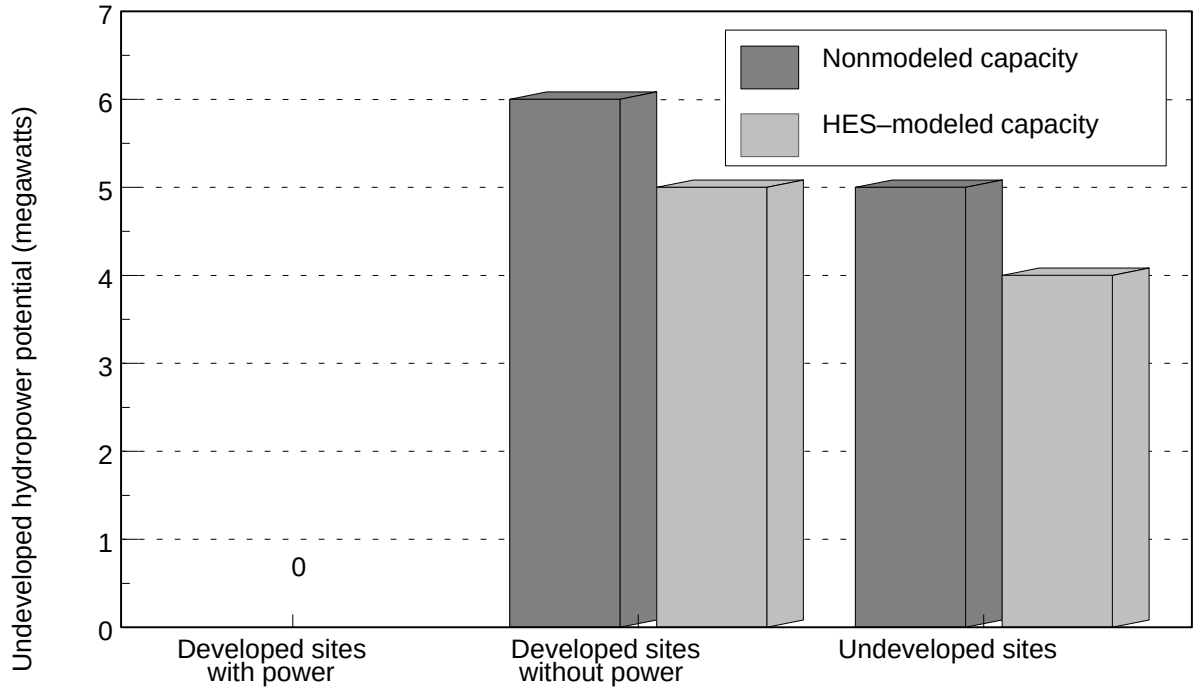

Figure 2. The nonmodeled and HES-modeled undeveloped hydropower potential.

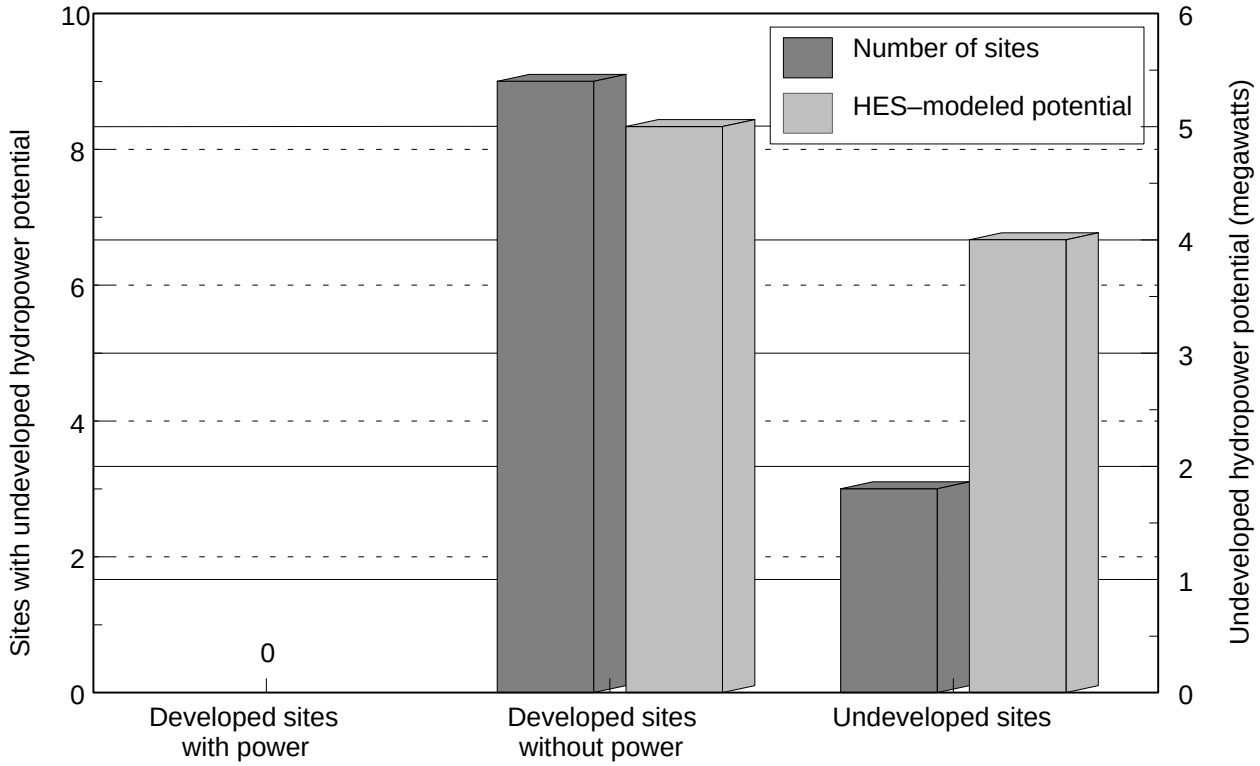

Figure 3. The number of sites with undeveloped hydropower potential and the total megawatts of HES-modeled undeveloped hydropower potential.

The State of New Jersey also provided information on 469 small hydropower sites with a total of 22 MW. Due to their relatively small size (average potential capacity of 47 kW per site) and limited commercial value, they were not included in the model. Figure 7 illustrates the total number of these small sites per county. Figure 8 identifies the total unmodeled megawatts of hydropower potential capacity per county for the small sites.

Detailed Results

The appendices contain, in the form of HES–generated reports, detailed information about the undeveloped hydropower potential in New Jersey. The appendices contain the following information:

Appendix A — The undeveloped hydropower potential is summarized by dam status groups. The number of sites, nonmodeled undeveloped hydropower potential, and HES–modeled undeveloped hydropower potential is provided based on the dam status.

Appendix B — The hydropower resource assessment by river basin includes the project number, project name, stream name, dam status, nonmodeled undeveloped hydropower potential, and the HES–modeled undeveloped hydropower potential for each of the individual sites. Subtotals are provided for each river basin.

Appendix C — This is a listing of the project numbers, plant name, stream name, if a site is Federally owned, nonmodeled undeveloped hydropower potential, and HES–modeled undeveloped hydropower potential. The sites are grouped by dam status.

Figure 4. The Great Falls plant is an example of a developed New Jersey hydropower plant in an urban setting. The plant is the large brick building in the left center of the picture above. The Great Falls waterfall is located in the background, under the pedestrian and water piping bridges. The Great Falls power plant is a National Historic Landmark, located on the Passaic River, in Paterson, New Jersey. The plant, which has a capacity of 10.95 MW and a head of 67 feet, was initially placed into service in 1914. It received a major upgrading during the 1980s. Parts of the diversion dam and water conveyance system date to the 1840s.

Appendix D This section contains a resource database list for each of the 149 sites in New Jersey. Information includes plant name, stream, state, county, river basin and owner names, project number, name plate and HES–modeled undeveloped hydropower potential, the unit and plant types, dam status, latitude, longitude, and the environmental factors that the HES uses to determine the project environmental suitability factor.

Appendix E This appendix lists 469 small sites (average capacity of 47 kW per site) with a total hydropower potential capacity of 22 MW. The list is sorted on county name and river.

OBTAINING INDIVIDUAL STATE INFORMATION

Additional copies of the hydropower resource assessment results for individual states are available and can be obtained by writing or calling the authors or the National Technical Information Service (NTIS).

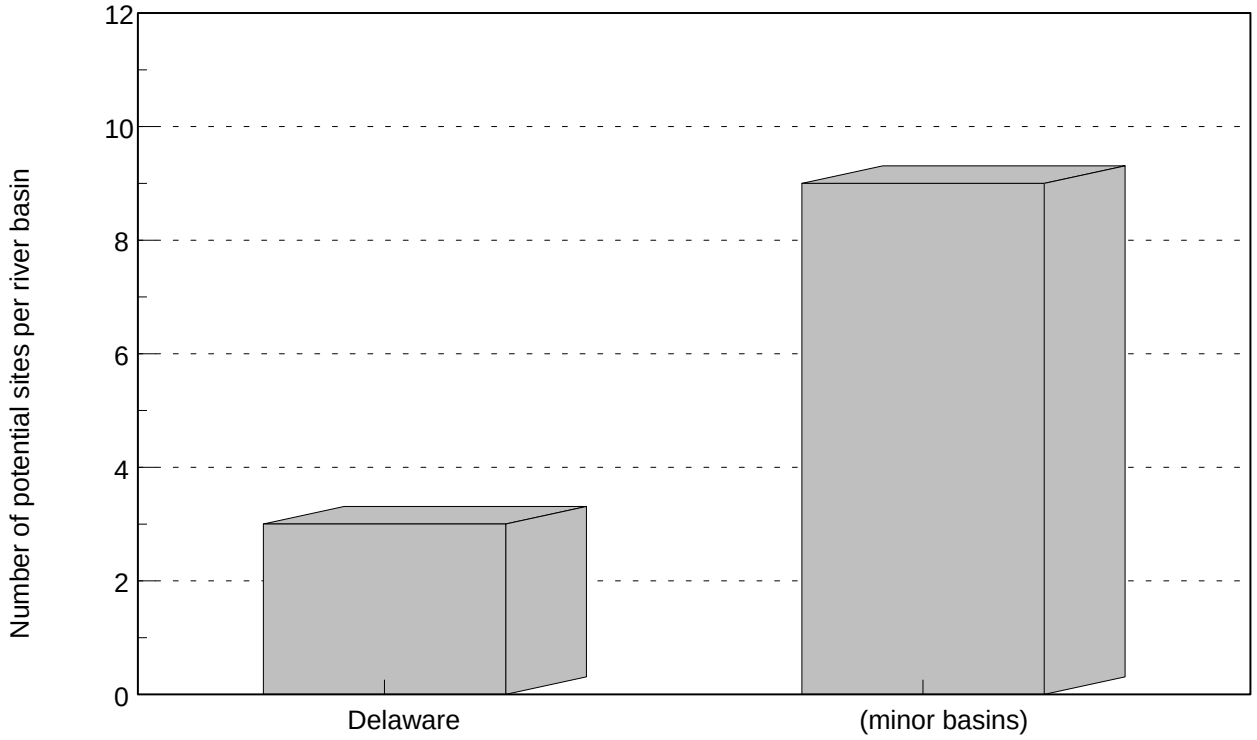

Figure 5. Number of sites with undeveloped hydropower potential in the New Jersey river basins.

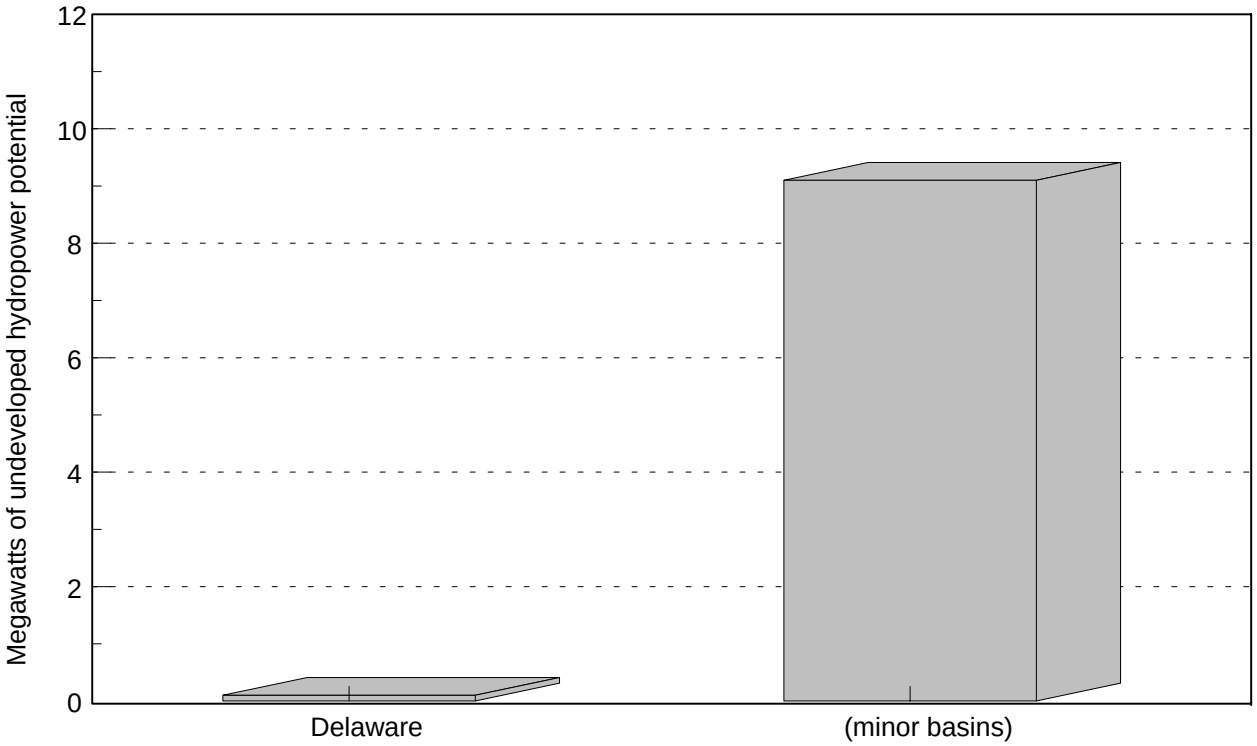

Figure 6. Megawatts of HES-modeled undeveloped hydropower potential in the New Jersey river basins.

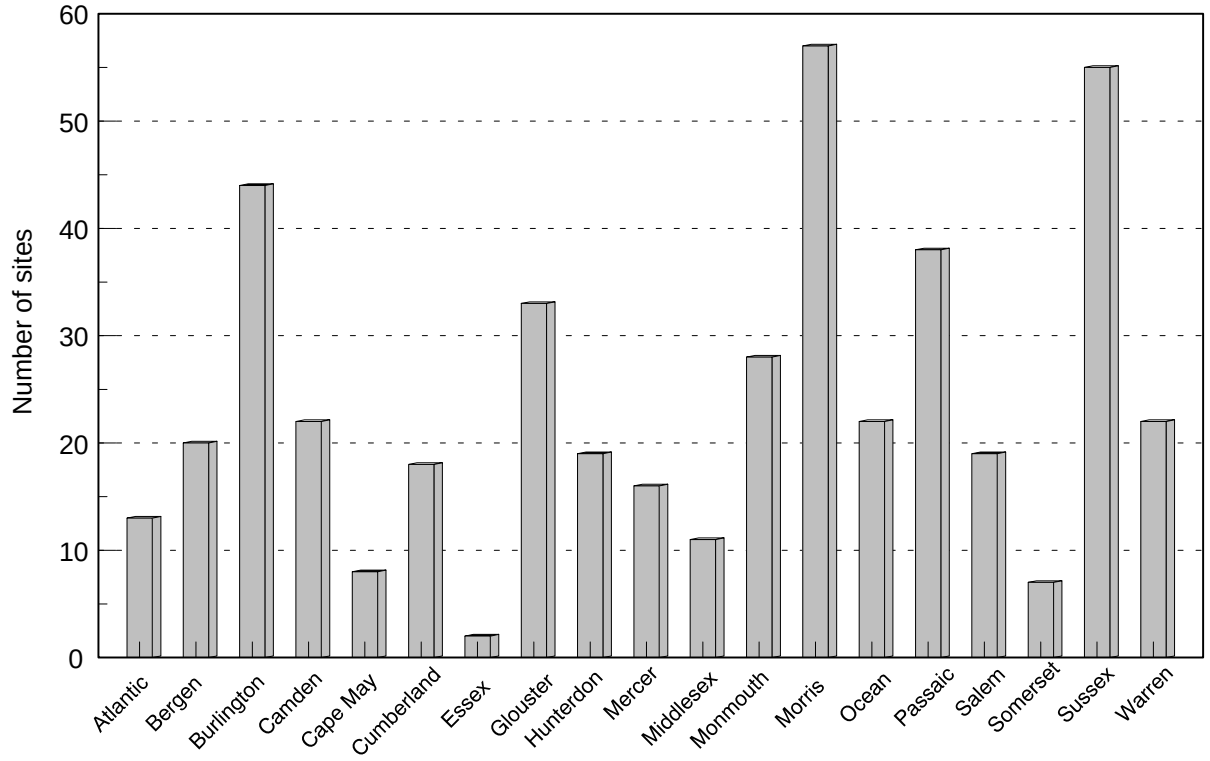

Figure 7. Number of small sites per county.

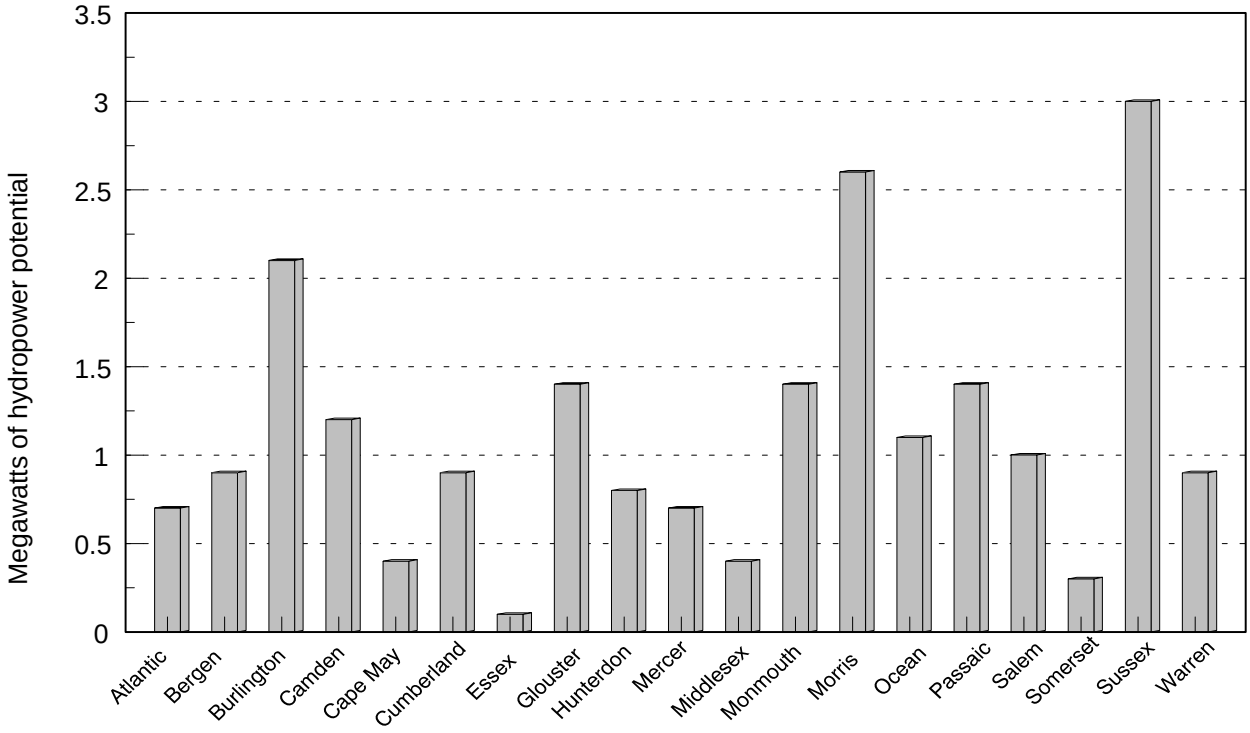

Figure 8. Nonmodeled hydropower potential capacity per county for the small sites.

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ADDITIONAL HYDROPOWER EVALUATION SOFTWARE INFORMATION

Additional information concerning the HES can be obtained by contacting Ben Rinehart or Jim Francfort at the addresses provided below. Copies of the software and the User's Manual may also be obtained from these individuals.

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Information concerning the State of New Jersey's involvement with the resource assessment or about the identified sites may be obtained by contacting:

William Crom
State of New Jersey
Energy Conservation Program
Board of Public Utilities
Two Gateway Center
Newark, NJ 07102
(201) 648–7252

REFERENCES

Francfort, J. E., S. D. Matthews, and B. N. Rinehart, 1991, *Hydropower Evaluation Software User's Manual*, DOE/ID–10338, Idaho National Engineering Laboratory, Idaho Falls, Idaho.

Conner, A. M., J. E. Francfort, and B. N. Rinehart, 1996, *Uniform Criteria for U.S. Hydropower Resource Assessment, Hydropower Evaluation Software Status Report–II*, DOE/ID 10430.1, Idaho National Engineering Laboratory, Idaho Falls, Idaho.